City of Albuquerque
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

July 21, 2000

Craig W. Hoover, P.E.
Bohannan Huston, Inc.
7500 Jefferson NE
Albuquerque, New Mexico 87109

RE: ***Addendum # 4 For The Design Analysis Report For Ventana Ranch Subdivision, (B10/D3), Engineer's Stamp Dated 7/3/00.***

Dear Mr. Hoover:

City Hydrology has no objection to the drainage concepts presented in the above referenced Addendum to the Design Analysis Report for Ventana Ranch.

Please coordinate with AMAFCA and address any comments that they may have. AMAFCA approval is required for the proposed discharge into the West Branch of the Calabacillas.

If you have any questions, or if I may be of further assistance, please call me at 924-3982.

Sincerely,

Susan M. Calongne, P.E.
City/County Floodplain Administrator

c: Kurt Browning, Las Ventanas Limited Partnership
Don Dixon, Albuquerque Metropolitan Arroyo Flood Control Authority
File

City of Albuquerque
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

February 1, 2000

Kerry Davis, P.E.
Bohannan Huston, Inc.
7500 Jefferson NE
Albuquerque, New Mexico 87109

RE: ***Revised Mass Grading Plan for Ventana Ranch (B9/D3), Engineer's Stamp Dated 1/27/00.***

Dear Mr. Davis:

The above referenced revised master Grading plan for the Ventana Ranch development is approved for Rough Grading permit release per Fred Aguirre's signature of January 28, 2000.

If you have any questions, or if I may be of further assistance to you, please call me at 924-3982.

Sincerely,

Susan M. Calongne, P.E.
City/County Floodplain Administrator

c: Kurt Browning, Las Ventanas Limited Partnership
File

City of Albuquerque
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

December 23, 1997

Craig W. Hoover, P.E.
Bohannan Huston, Inc.
7500 Jefferson NE
Albuquerque, New Mexico 87109

RE: Las Ventanas Drainage Master Plan - Amendment to Addendum # 3, (B10/D3), Revised December 5, 1997.

Dear Mr. Hoover:

The above referenced Addendum addresses the development of Tract 27A instead of Tract 22A. Based on the information provided in the submittal of December 5, 1997, the Amendment to Addendum # 3 of the Las Ventanas Drainage Master Plan is acceptable to City Hydrology.

As you are aware, all development of the tracts within Las Ventanas must be in accordance with the Master Plan and phasing plan.

If you should have any questions, please do not hesitate to call me at 924-3982.

Sincerely,

Susan M. Calongne, P.E.
City/County Floodplain Administrator

c: Kurt Browning, AMAFCA
Cleve Matthews, Sandia Properties
File

CITY OF
Albuquerque

July 28, 1997

Martin J. Chávez, Mayor

Craig Hoover
Bohannan Huston, Inc.
7500 Jefferson NE
Albuquerque, New Mexico 87109

RE: Las Ventanas Drainage Master Plan - Addendum # 3, (B10/D3), Dated June 17, 1997.

Dear Mr. Hoover:

The above referenced Addendum addresses the mass grading of Tract 3 and the development of Tracts 3, 8, 9 and 22A. Any development of Tracts 3, 8 or 9 requires additional ponding on Tract 5. Based on the information provided in the submittal of July 16, 1997, Addendum # 3 of the Las Ventanas Drainage Master Plan is acceptable to City Hydrology.

As you are aware, all development of the tracts within Las Ventanas must be in accordance with the Master Plan and phasing plan.

If you should have any questions, please do not hesitate to call me at 924-3982.

Sincerely,

Susan Calongne

Susan M. Calongne, P.E.
City/County Floodplain Administrator

c: Kurt Browning, AMAFCA
Kerry Davis, Bohannan Huston
Cleve Matthews, Sandia Properties
File

CITY OF
Albuquerque
Public Works Department

May 1, 1997

Martin J. Chávez, Mayor

Robert E. Gurulé, Director

Howard C. Stone, P.E.
Bohannan Huston, Inc.
7500 Jefferson NE
Albuquerque, New Mexico 87109

RE: Las Ventanas Drainage Master Plan - Addendum # 2, (B10/D3), Dated April 24, 1997.

Dear Mr. Stone:

The above referenced Addendum identifies the capacity of the playa with the modifications to be constructed by Sandia Properties. Based on the information provided in the submittal of April 29, 1997, Addendum # 2 of the Las Ventanas Drainage Master Plan is acceptable to City Hydrology.

As you are aware, all development of the tracts within Las Ventanas must be in accordance with the Master Plan and phasing plan.

If you should have any questions, please do not hesitate to call me at 924-3982.

Sincerely,

Susan Calongne

Susan M. Calongne, P.E.
City/County Floodplain Administrator

c: Kurt Browning, AMAFCA
Cleve Matthews, Sandia Properties
File

City of Albuquerque
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

February 22, 1996

Tamara K. Morgan, P.E.
Bohannan Huston, Inc.
7500 Jefferson NE
Albuquerque, New Mexico 87109

RE: GRADING PLAN FOR TRACT 3A, VENTANA RANCH (B10/D3), SUBMITTED FOR ROUGH GRADING APPROVAL, ENGINEER'S STAMP DATED 2/8/96.

Dear Ms. Morgan:

Based on the information provided in the submittal of February 13, 1996, the above referenced plan is approved for Rough Grading.

Please be advised that a top-soil disturbance permit must be obtained before any grading may occur on this Tract.

If you should have any questions, please feel free to call me at 768-2666.

Sincerely,

Susan Calongne

Susan M. Calongne, P.E.
City/County Floodplain Administrator

c: Andrew Garcia, City Hydrology
Larry Caudill, Environmental Health
File

City of Albuquerque
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

August 8, 1995

Howard C. Stone, P.E.
Bohannan Huston, Inc.
7500 Jefferson NE
Albuquerque, New Mexico 87109

RE: DRAINAGE MASTER PLAN FOR LAS VENTANAS SUBDIVISION (B10/D3), SUBMITTED FOR BULK LAND PLAT APPROVAL, ENGINEER'S STAMP DATED JULY 1995.

Dear Mr. Stone:

Based on the information provided in the resubmittal of July 19, 1995, the drainage concepts presented in the above referenced Drainage Master Plan are acceptable for Bulk Land Plat approval with the following exception.

The plan proposes to allow the runoff from Basins 601 and 602 to flow in the north half of Paseo del Norte to Rainbow Boulevard, and at that point to collect this flow by inlets and deposit them under PDN to an existing arroyo which flows to the Boca Negra system. These flows are considered public waters, therefore they may not be directed into the existing arroyo unless the arroyo is within a public easement or right-of-way. This runoff may be conveyed into the Las Ventanas Subdivision if the easements or rights-of-way are not in place.

If you should have any questions, please do not hesitate to call me at 768-2666.

Sincerely,

Susan Calongne

Susan M. Calongne, P.E.
City/County Floodplain Administrator

c: Kurt Browning, AMAFCA
Cleve Matthews, Owner
Fred Aguirre, City Hydrology
File

ADDENDUM NO. 4
FOR THE DESIGN ANALYSIS REPORT
FOR VENTANA RANCH SUBDIVISION DRAINAGE FACILITIES

JULY 3, 2000

PREPARED BY:

BOHANNAN HUSTON, INC.
COURTYARD I, 7500 JEFFERSON STREET N.E.
ALBUQUERQUE, NM 87109

PREPARED FOR:

LAS VENTANAS LTD. PARTNERSHIP
#10 TRAMWAY LOOP
ALBUQUERQUE, NM 87122

I, Craig W. Hoover, hereby certify that I am a Registered Professional Engineer registered in the state of New Mexico, and that the following report was prepared under my direction and is true and correct to the best of my knowledge and belief.

CRAIG W. HOOVER
NEW MEXICO
11848
REGISTERED PROFESSIONAL ENGINEER

Craig W. Hoover P.E.
NMPE No. 11848

'10

EXECUTIVE SUMMARY

This report constitutes Addendum No. 4 for the Design Analysis Report for Ventana Ranch Subdivision Drainage Facilities, Bohannan Huston, October 1995 (Design Report) prepared for Las Ventanas Limited Partnership. The purpose of this report is to examine the hydrology and storm drain hydraulics, as presented in Addendum No. 3 to the Design Report, Bohannan Huston, March 8,1999, for the tracts in the northernmost portion of Ventana Ranch. Addendum No. 3 addresses the drainage requirements for the northern portion of Ventana Ranch west of Universal Boulevard, specifically the North Outfall and West Branch Calabacillas Storm Drain watershed. The re-evaluation is based on the following modifications:

1. a **minor** adjustment to the watershed divide between the North Outfall and the West Branch Calabacillas Storm Drain Diversion;
2. the inclusion of three acres from Tract 11 into the West Branch Calabacillas Storm Drain Diversion system;
3. the adjusted areas for Tract 15 (formally labeled Tract 14) and basin ST14 (Rainbow Blvd. At Las Ventanas Rd.) in the West Branch Calabacillas Storm Drain Diversion system;
4. a reconfiguration of basins 25A, 25B, and 26 from three basins to two basins and the removal of basin ST15 (Rainbow Boulevard) from the hydrologic model for the West Branch Calabacillas Storm Drain Diversion

The minor refinement of the subdivision grading plan accounts for the majority of the changes to the modeled hydrology. The reconfiguration of basins 25A, 25B and 26 was done to improve the model to more closely match actual drainage conditions in these basins. With the above modifications, the total system acreage for the North Outfall and the West Branch Calabacillas systems become 123 acres and 193 acres, respectively compared to 122 acres and 197 acres as presented in Addendum No. 3

The slight adjustment of the watershed divide between the North Outfall and the West Branch Calabacillas Storm Drain Diversion changes the areas from Tracts 23 and 24

and small portions of Tracts 13, 24 and 28B that contribute flow to the north directly into the West Branch of the Calabacillas Arroyo. The North Outfall was sized as a 66-inch diameter pipe in Addendum No. 3, which allows free discharge of off-site Tracts A and B into the AMAFCA and City approved outfall. Tract B is now owned by Las Montanas Limited Partnership. The re-evaluation of the hydrology establishes a total discharge of 330 cfs into the West Branch of the Calabacillas Arroyo. The hydraulics presented in Addendum No. 3 for the North Outfall are still applicable as this flow rate does not exceed the agreed allowable discharge of 333 cfs. Refer to the agreement with downstream property owners prepared and exacted as part of Addendum No. 3 on the allowable discharge in Appendix B.

A future storm system is identified within the North Outfall West Branch Calabacillas Arroyo Watershed. Analysis of a temporary pond within this basin is provided that has the capacity to serve approximately 40 acres of residential development within Tract X-1-A-1. The temporary pond, that will be located within tract X-1-A-1, is covered by a temporary blanket drainage easement and private maintenance covenant. The temporary pond is sized for the 100-year 10 day runoff volume, although a small outlet pipe would be provided to drain the pond in approximately 24 hours.

In addition to the North Outfall, this addendum slightly modifies the West Branch Calabacillas Storm Drain Diversion hydrology. The net effect of the modifications to the hydrology is a small reduction in discharge to the West Branch Calabacillas Storm Drain Diversion. The revised flow rates, however, do not change the recommended pipe sizes as presented in Addendum No. 3.

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I. INTRODUCTION

This report constitutes Addendum No. 4 for the Design Analysis Report for Ventana Ranch Subdivision Drainage Facilities, Bohannan Huston, October 1995 (Design Report prepared for Las Ventanas Limited Partnership. This report re-evaluates the hydrology and hydraulics for drainage outfall options for tracts in the northcentral portion of Ventana Ranch, a subdivision in northwest Albuquerque.

This addendum proposes a minor adjustment in the watershed divide between the North Outfall and the West Branch Calabacillas Storm Drain Diversion. The change in the watershed divide is to account for the refinement of the subdivision grading plan. The change in the watershed divide effects basins 1, 2, and 4 for the North Outfall hydrologic model and basins 13, 24, and 28 for the West Branch Calabacillas Storm Drain Diversion system.

This addendum also adds three acres from Tract 11 into the West Branch Calabacillas Storm Drain Diversion system (see Figure 1). In addition, the area for Tract 15 (formally labeled Tract 14) has been corrected and is 33 acres (formally it was modeled as 33.2 acres). Two of the Rainbow Boulevard basins were modified to account for changed grading of the street. Basin ST15 (previously located just west of Tract 22) was removed from the model since the runoff will flow to the south, out of the area being modeled. The area of basin ST14 (at the intersection of Rainbow Boulevard and Las Ventanas Road) was modified to account for the adjusted location of the high point on Rainbow Boulevard. Finally, basins 25A, 25B, and 26 from Addendum 3 were reconfigured and combined into two basins, 25A and 26. The reconfiguration was done to better represent the actual layout of the subdivision.

All of these minor modifications lead to the re-evaluation of the hydrology and hydraulics for the North Outfall and the West Branch Calabacillas Storm Drain Diversion. The results and conclusions of the review are presented in this report. Considering the modifications to the drainage areas for the North Outfall and the West Branch Calabacillas Storm Drain Diversion, this report impacts Ventana Ranch Tracts 11, 12, 13, 15, 22A, 23, 24, 25A, 25B, 26A, 26B, 28A, 28B, and 29 (see Figure 1).

NOTES:

1. BASINS 1-6 CONTRIBUTE TO THE NORTH OUTFALL. OTHER BASINS CONTRIBUTE TO WEST BRANCH CALABACILLAS STORM DRAIN DIVERSION.
2. BASIN ST15 CONTRIBUTES TO THE PIEDRAS MARCADAS SYSTEM.

WEST BRANCH OF CALABACILLAS ARROYO
66 CFS
OFF-SITE TRACT A
OFF-SITE TRACT B
73 CFS
BASIN 5
BASIN 6
ROCK OUTCROP
TEMPORARY RETENTION POND
BASIN 3W 16CFS
BASIN 3E 13CFS
IRVING BLVD.
BASIN 4 24CFS
STS 10CFS
BASIN 502
TRACT 12
TRACT 13
TRACT 23
50CFS
BASIN 1
BASIN 2 133CFS
TRACT 29
TRACT A
76CFS
90CFS
58CFS
10 CFS
TRACT 11
ST12 8CFS
15N
ST13 6CFS
ST14 4CFS
ST24 6CFS
TRACT 24
32CFS
TRACT 28B
TRACT 15
68CFS
TRACT 22
TRACT 25A
28CFS
TRACT 25B
TRACT 28A
ST15
61CFS
15S
45CFS
39CFS
38 CFS
ST28 8CFS
LAS VENTANAS RD.
RAINBOW BLVD.
VENTANA VILLAGE RD.
VENTANA RANCH RD.
TRACT 26A 48CFS
TRACT 26B
UNIVERSE BLVD.
VENTANA RD.
NORTH BRANCH PIEDRAS MARCADAS CHANNEL
PARADISE BLVD.

LEGEND

- WATERSHED DIVIDE
- BASIN BOUNDARY
- 90CFS → 100-YEAR FLOW RATE AND DIRECTION
- BASINS DRAINING TO NORTH OUTFALL
- TEMPORARY RETENTION POND MAY BE CONSTRUCTED WITHIN TRACT 29 TO CONTROL RUNOFF UNTIL THE NORTH OUTFALL IS CONSTRUCTED

N

600 300 0 600

SCALE: 1"=600'

Bohannan Huston
Courtyard One 7500 JEFFERSON NE Albuquerque NEW MEXICO 87109
ENGINEERS PLANNERS PHOTOGRAMMETRISTS SURVEYORS SOFTWARE DEVELOPERS

VENTANA RANCH
FIGURE 1
DRAINAGE BASIN MAP
DEVELOPED CONDITIONS
JUNE 2000

II. PURPOSE

The purpose of this report is to confirm that the proposed changes in the subdivision and the resulting changes in the hydrology do not change the storm drain hydraulics for the North Outfall or the West Branch Calabacillas Storm Drain Diversion, as presented in Addendum No. 3. Addendum No. 3 was approved by the City of Albuquerque and by AMAFCA. Using the revised hydrology, the hydraulics for the North Outfall and the West Branch Calabacillas Storm Drain Diversion were checked to assure adequate capacity for the revised flow rates.

III. NORTH OUTFALL

Addendum No. 3 presented five development scenarios for the North Outfall and recommended the scenario for free discharge of the developed flows to the West Branch of the Calabacillas Arroyo from Ventana Ranch. In the recommended scenario, the revised watershed draining north included all of Tracts 23 and 29, portions of Tracts 13, 24, and 28B, portions of Irving Boulevard and Rainbow Boulevard, and off-site Tracts A and B (122 acres total). The change to hydrology for the North Outfall for this addendum is due to proposed minor grading changes in the subdivision and the resulting slight change in the watershed divide between the North Outfall and the West Branch Calabacillas Storm Drain Diversion (see Figure 1). The change in the watershed divide increases the contributing areas from Tract 13 and Tract 23 and decreases the contributing areas from Tracts 28B and 24. The overall result is a minimal increase in the drainage area to the north from 122 acres to 123 acres.

The hydrology was remodeled with the slight area change and some minor basin boundary and storm drain route revisions. The basin boundary and route revisions were done to more accurately represent the proposed storm drain system in the area. The Appendix contains the AHYMO model summary table and the time of concentration calculations. With the revised watershed area, the flow rate into the arroyo from Ventana Ranch and developed off-site Tracts A and B is 330 cfs. The downstream owner has

agreed to accept up to 333 cfs from this system (see Appendix B for the agreement between Westfork Limited and Las Ventanas Limited Partnership).

The proposed pipe sizes for the North Outfall storm drain will not change from those proposed in Addendum No. 3. The proposed hydraulics are summarized in the following table and in Figure 2.

A storm drain within Tracts 23 and 29 is proposed connecting to the North Outfall. This storm drain will serve the intersection of Irving and Rainbow Boulevard, as well as Tracts 23 and 29. The preliminary location of the main storm drain line is shown in Figure 2. The exact size and location of this storm drain will be determined with the development plans for Tracts 23 and 29. Preliminary sizes for the storm drain are summarized in Table 1 and in Figure 2.

The storm drain pipe sizes were determined using Manning's equation with a roughness coefficient of 0.013. Maximum pipe carrying capacities using Manning's equation were calculated for each pipe size for full pipe flow conditions.

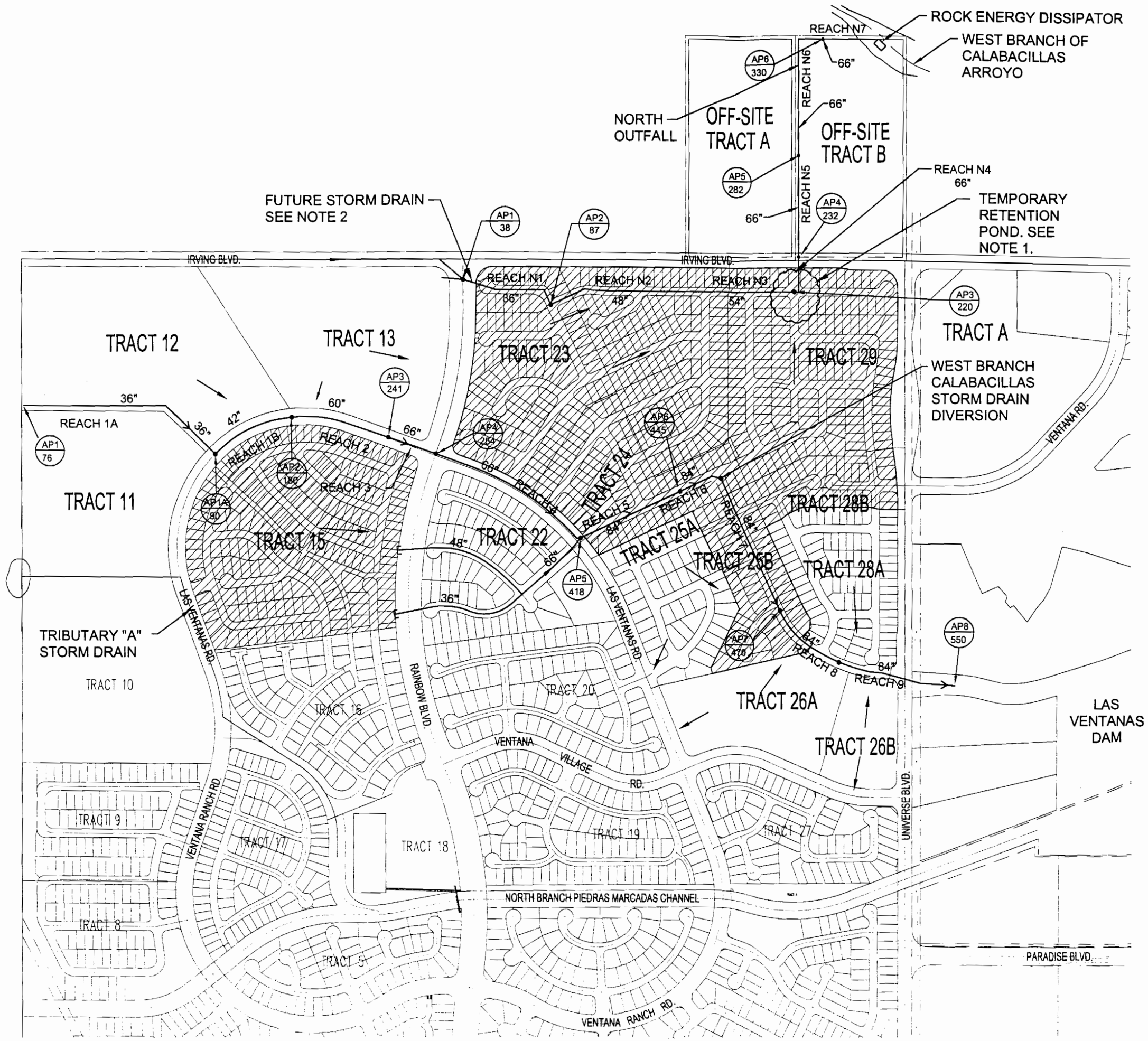
TABLE 1

NORTH OUTFALL TO ARROYO

Reach Designation	Peak 100-Year Flow (cfs)	Drainage Areas Included	Minimum Slope (ft/ft)	Pipe Size (inches)	Pipe Capacity* (cfs)
N1	87	West Basin of Irving Blvd., Rainbow Blvd., and part of Tract 13	0.013	36	113
N2	130	Add in Tract 23	0.013	48	144
N3	200	Add in Part of Tract 29	0.013	54	218
N4	220	Add in All of Tract 29	0.0071	66	283
N5	232	Add in the East Basin of Irving Blvd.	0.0071	66	283
N6	282	Ventana Ranch and off-site Tract A	0.0071	66	283
N7	330	Ventana Ranch and off-site Tracts A and B	0.010	66	335

* Assuming full pipe flow conditions

For phasing purposes a temporary retention pond similar to the pond that was required at the end of the 84" storm drain with the Country Meadows Subdivision, will be constructed within Tract 29 until the North Outfall pipe is constructed. This pond will be located just south of Irving Boulevard, where the North Outfall pipe crosses Irving Boulevard (refer to Figures 2 and 3). The pond will be formed by the existing depression in this area and by the final grade of Irving Boulevard. The pond will have a small outflow pipe to allow slow drainage from the pond. The exact size and location of the pond outfall will be determined with the development plans for Tracts 23 and 29



LEGEND

- WEST BRANCH CALABACILLAS STORM DRAIN DIVERSION AND NORTH OUFALL STORM DRAIN
- FLOW DIRECTION
- AP1 / 76 — ANALYSIS POINT 100-YR FLOW (CFS)
- CONCEPTUAL PROPOSED LOT LAYOUTS

NOTES:

1. A TEMPORARY RETENTION POND MAY BE CONSTRUCTED WITHIN TRACT 29 TO CONTROL RUNOFF UNTIL THE NORTH OUTFALL IS CONSTRUCTED. EASEMENT AND COVENANT IN PLACE - SEE PLAT FOR TRACT X-1-A-1 (APPENDIX C).
2. WITH THE DEVELOPMENT OF TRACTS 23, 24, &29, A STORM DRAIN WILL BE CONSTRUCTED TO CONVEY RUNOFF FROM THE NORTHEAST CORNER OF TRACT 13, IRVING BOULEVARD AND RAINBOW AT IRVING. THIS STORM DRAIN WILL ALSO SERVE TRACTS 23, 24, & 29.
3. ADDENDUM NO. 3 ADDRESSED THE NORTH OUTFALL TO THE WEST BRANCH OF THE CALABACILLAS AND WAS APPROVED BY THE CITY OF ALBUQUERQUE AND BY AMAFCA.

Bohannan ▲ Huston
Courtyard One 7500 JEFFERSON NE Albuquerque NEW MEXICO 87109
ENGINEERS PLANNERS PHOTOGRAMMETRISTS SURVEYORS SOFTWARE DEVELOPERS

VENTANA RANCH
FIGURE 2
PROPOSED DRAINAGE PLAN
DEVELOPED CONDITIONS
JUNE 2000

A BHH 801.99439.HYDRO DESIGN DWGS ALL - SITE1.DWG 4-12-00

Proposed phasing that will contribute to the retention pond is shown in Figure 3. The pond volume available, considering the proposed phasing and its encroachment into the existing depression, is 19 acre-feet. The total volume of runoff for the [illegible] day storm contributing to the temporary pond is calculated to be 9.8 acre-feet. The temporary pond has adequate capacity so that the North Outfall could be constructed after the areas shown in Figure 3 have been completed. Runoff volume calculations are included in the Appendix A.

The pond is proposed to be constructed with Tract X-1-A-1 upon which a temporary blanket drainage easement and private maintenance covenant have been placed. A copy of the plat granting this drainage easement is enclosed in the back pocket as Exhibit 1. Note 8 on sheet 1 of the plat spells out the conditions of the temporary blanket drainage easement. The pond is sized as a retention pond with capacity to store the 100-year, 10-day storm, although a small outlet pipe is prepared to drain the pond in approximately 24 hours. It should be noted that the downstream tract noted as off-site Tract B, is also owned by the developer of Ventana Ranch.

IRVING BLVD.

RAINBOW BLVD.

UNIVERSE BLVD.

TEMPORARY POND

PHASE 4
FUTURE TRACT 29B
30.0 AC.

TEMPORARY OUTLET PIPE AT LOCATION OF FUTURE NORTH OUTFALL STORM DRAIN

PHASE 3
FUTURE TRACT 23
15.2 AC.

TRACT X-1-A-1

PHASE 2
FUTURE TRACT 29A
13.6 AC.

TRACT A-1

PHASE 1
FUTURE TRACT 24
18.9 AC.

TRACT 28B

LAS VENTANAS RD.

TERRAZAS
SUBD.

BRADFORD HILLS
SUBD.

TRACT 25B-1

COUNTRY
MEADOWS
SUBD.

N

LEGEND

PHASE BOUNDARY

200 100 0 200

SCALE: 1" = 200'

P:\56\DGN\GENERAL\FIGURE-3.DGN

Bohannan Huston
Courtyard One 7500 JEFFERSON NE Albuquerque NEW MEXICO 87109
ENGINEERS PLANNERS PHOTOGRAMMETRISTS SURVEYORS SOFTWARE DEVELOPERS

VENTANA RANCH
FIGURE 3
PHASING PLAN

JUNE 2000

IV. WEST BRANCH CALABACILLAS STORM DRAIN DIVERSION

The hydrology for the West Branch Calabacillas Storm Drain Diversion was modified to account for the changes affecting the watershed:

1. The proposed grading changes to the subdivision and the resulting change in the watershed divide between the North Outfall and the West Branch Calabacillas Storm Drain Diversion (see Figure 1);
2. The addition of three acres of Tract 11 into the Diversion system; and
3. The corrected area values for Tract 15 (formally labeled Tract 14) from 3.2 acres to 33 acres and for basin ST14 from 2.6 acres to 1.2 acres.
4. a change in configuration to basins 25A, 25B, and 26 from three basins to two basins;
5. and the removal of basin ST15 (Rainbow Blvd.) from the hydrologic model for the West Branch Calabacillas Storm Drain Diversion.

The revised AHYMO model and time of concentration calculations are included in the Appendix.

The adjustment to the watershed divide slightly increased the drainage area to the Diversion for the Tract 28 basin and slightly decreased the areas of Tract 13 and Tract 24 draining to the Diversion (see Figure 1). Overall, the adjustment to the watershed removed approximately 8 cfs from the West Branch Calabacillas Storm Drain Diversion system. The other modifications to the model all had minor effects on the overall discharge to the system. The addition of three acres of Tract 11 into the system added approximately 7 cfs to the discharge. The correction of the Tract 15 area and the ST14 basin area slightly reduced the flow rate to the Diversion (approximately 8 cfs together). The reconfiguration and refinement of the grading of the basins for Tracts 25A, 25B and 26 A and B, resulted in a slightly smaller area contributing to the Diversion and therefore a reduction of approximately 3 cfs of discharge. The elimination of basin ST15 from the system removed approximately 6 cfs of discharge. The net result of the changes reduced the total watershed from 197.4 acres to 192.5 acres, and reduced the 100-year peak flow rate from 567 cfs to 550 cfs.

The Diversion pipe sizes for Reaches 1A through 9 were determined using Manning's equation with a roughness coefficient of 0.013 and preliminary hydraulic grade line calculations to check for reaches in pressure flow. Maximum pipe carrying capacities using Manning's equation were calculated for each pipe size for full pipe flow conditions. The proposed pipe sizes for the Diversion reaches are summarized in the following table and shown on Figure 2. Reaches 3 and 4 have already been designed for pressure flow; therefore the storm drain sizes in the table reflect this analysis.

TABLE 2
WEST BRANCH CALABACILLAS STORM DRAIN DIVERSION

Reach Designation	Peak 100-Year Flow (cfs)	Minimum Slope (ft/ft)	Pipe Size (inches)	Pipe Capacity* (cfs)
1A	76	0.0167	36	86
1B	90	0.007	42	90
2	180	0.006	60	200
3**	241	0.0037	66	204
4**	254	0.006	66	260
5	448	0.0061	84	500
6	448	0.0061	84	500
7	470	0.0061	84	500
8	550	0.009	84	640
9	550	0.009	84	640

* Assuming full pipe flow conditions using Manning's equation.
** Reaches 3 and 4 have been designed and analyzed for pressure flow. This analysis is included in the Appendix for reference.

The revised grading and hydrology does not change the pipe sizes for the West Branch Calabacillas Storm Drain Diversion from those presented in Addendum No. 3. In Addendum No. 3 the Diversion pipes were sized based on Manning's equation and the assumption of non-pressure flow. As the design of the system has progressed, reaches 3 and 4 have been designed as pressure flow, allowing the pipe size to be reduced from the original recommended size of 72-inch diameter to 66-inch diameter pipe. Design of the Diversion has also changed some of the pipe slopes from those originally presented in Addendum No. 3, though none of these changes have required increases to the size of the storm drain.

V. CONCLUSION AND RECOMMENDATION

Based on the above analysis, the proposed changes to the North Outfall and the West Branch Calabacillas Storm Drain Diversion watersheds *do not have a significant impact on the hydrology or the proposed storm drain hydraulics recommended in Addendum No. 3.* The changes cause a minor increase in flow to the North Outfall, though not significant enough to alter the proposed hydraulics of the Outfall. The changes cause a small decrease in the flow to the West Branch Calabacillas Storm Drain. Again, this decrease is not significant enough to cause any changes in the original storm drain sizes proposed in Addendum No. 3.

For phasing purposes a temporary retention pond will be constructed within Tract 29 until the North Outfall pipe is constructed. Additional detailed information will be provided with the drainage reports for each subdivision.

★ Temporary Pond Size

- Size based on 100 yr, 10 day runoff volume.
- Calculated using equations from the DPM
  - Eqn. A-9: $V_{10\,days} = V_{360} + A_D (P_{10\,days} - P_{360})/12\ in/ft$

$V_{360} = E A / 12\ in/ft$ (A: acres; inches)

$E = \frac{0.44(\text{Area A}) + 0.67(\text{Area B}) + 0.99(\text{Area C}) + 1.97(\text{Area D})}{\text{Total Area}}$ per Zone 1

A_D = area that is impervious

$P_{10\,days} = 10 - (24.9/(P_{1440})^{1.4}) = \boxed{3.67"}$

$P_{1440} = 2.66"$

$P_{360} = 2.2"$

★ Phase 1 (Future Tract 24)

A = 18.9 acres

%A = 0	%B = 25	%C = 25	%D = 50
A = 0	A = 4.725 ac	A = 4.725 ac	A = 9.45 ac

$$E = \frac{0.44(0) + 0.67(4.725) + 0.99(4.725) + 1.97(9.45)}{18.9}$$

$= 1.4$

$V_{360} = 1.4\ in \times 18.9\ ac/12\ in/ft = 2.21\ ac\text{-}ft$

$V_{10\,days} = 2.21 + 9.45(3.67 - 2.2)/12$

$= \boxed{3.4\ ac\text{-}ft}$

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★ Phase 2 (Future Tract 29A)

A = 13.6 acres

%A = 0	%B = 25	%C = 25	%D = 50
A = 0	A = 3.4 ac	A = 3.4 ac	A = 6.8 ac

$$E = \frac{0.44(0) + 0.67(3.4) + 0.99(3.4) + 1.97(6.8)}{13.6}$$

$= 1.4$

$V_{360} = 1.4 in \times 13.6 ac / 12 in/ft = 1.58$ ac-ft

$V_{10\,day} = 1.58 + 6.8 ac\,(3.67 - 2.2)/12$

$= \boxed{2.4}$ ac-ft

★ Phase 3 (Future Tract 23)

A = 15.2 acres

%A = 0	%B = 25	%C = 25	%D = 50
A = 0	A = 3.8 ac	A = 3.8 ac	A = 7.6 ac

$$E = \frac{0.44(0) + 0.67(3.8) + 0.99(3.8) + 1.97(7.6)}{15.2}$$

$= 1.4$

$V_{360} = 1.4 in \times 15.2 ac / 12 in/ft = 1.7$ ac-ft

$V_{10\,day} = 1.7 + 7.6(3.67 - 2.2)/12$

$= \boxed{2.6}$ ac-ft

★ TOTAL VOLUME OF 3 DEVELOPED PHASES = **8.4 ac-ft**

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* Phase 1 (Future Tract 29B - undeveloped area until pond is constructed)

A = 30.0 acres

%A = 75	%B = 0	%C = 25	%D = 0
A = 22.5 ac	A = 0	A = 7.5 ac	A = 0

$$E = \frac{0.44(22.5) + 0.67(0) + 0.99(7.5) + 1.97(0)}{30.0}$$

$= 0.57$ in

$V_{360} = 0.57\text{ in} \times 30.0\text{ ac}/12\text{ in/ft} = 1.4$ ac-ft

$V_{10day} = 1.4 + 0(3.67 - 2.2)/12$

$= \boxed{1.4 \text{ ac-ft}}$

Σ of all V_{10day} contributing to pond

$= 8.4 + 1.4 = \boxed{9.8 \text{ ac-ft}}$

* From pond spreadsheet - this puts the pond depth at just over 4 feet - leaving almost 2 feet of freeboard in the temporary pond.

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